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Delegation and Performance Pay: Evidence from Industrial Sales Forces

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Abstract

Delegation is a central feature of organizational design that theory suggests should be aligned with the power of incentives in performance pay schemes. Empirical research on factors that influence delegation, and on the relationship between delegation and pay-for-performance, however, remains scarce. We develop a simple model of the delegation decision in the context of industrial sales forces, where delegation takes the form of pricing authority given to sales persons. Consistent with the predictions of our model, we show that the power of incentives is positively and robustly related to the level of pricing authority. We also find that sales people are given more pricing authority when they have superior local information and are less biased. Finally, we find evidence that the positive effect of local information on the extent of delegation is increasing in pay-for-performance but decreasing in agent bias.
(JEL codes: D23; D82; L22; M31; M52)

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1. INTRODUCTION

The allocation of decision rights and the choice of compensation scheme are both important features of organizational design, reflecting how firms motivate their employees and coordinate their activities (Jensen and Meckling 1992; Brickley, Smith, and Zimmerman, 2009). But despite their importance, and the likely connection between these two features, the empirical literature has predominantly focused *either* on compensation schemes (e.g., John and Weitz 1989; Aggarwal and Samwick 1999; Lazear 2000; Lo, Ghosh, and Lafontaine 2011) *or* on the allocation of decision rights (e.g., Arrunada et al 2001; Abernethy, Bouwens, and van Lent 2004; Acemoglu et al. 2007; Rajan and Wulf 2006). There has been much less research on the latter, moreover, and even less on the relation between delegation and performance pay. Exceptions include Nagar (2002), who finds evidence that branch managers who are given more discretion – as measured using a perceptual scale – are also paid a greater proportion of their pay in the form of bonuses, and Foss and Laursen (2005) and DeVaro and Kurtulus (2010) who find a positive relationship between incentive pay and perceptual measures of delegation in Danish and British companies respectively. Relatedly, Wulf (2007) finds that the compensation of division managers who are designated also as corporate officers, and hence are expected to have higher decision-making authority, is more sensitive to firm-level performance than is the compensation of other division managers.

In this paper, we study the delegation of decision rights and its relation with compensation plans in the context of industrial equipment manufacturing firms and their direct sales forces. The context of industrial equipment sales is an appealing one to investigate these issues. First, industrial equipment is often very complex and needs to be customized to the customer's needs; hence manufacturers often rely on direct sales forces as their main channel of distribution (e.g., Anderson and Schmittlein 1984; Zoltners, Sinha, and Lorimer 2006, p.2).

Second, most firms in this sector confer a *specific* level of pricing authority to their sales people. For example, a sales person might be given the authority to unilaterally offer price discounts up to a certain percentage – say 10% – off the list price *without* having to confer with his/her superior. Discounts beyond the authorized level require explicit approval from the supervising manager. The level of pricing authority accorded to a specific sales person thus provides us with a unique, non-perceptual measure of delegation.

Finally, the incentive component of the compensation scheme for sales people in this industry predominantly takes the form of sales commission paid on revenues generated (e.g., John and Weitz 1989; Oyer 1998). This makes measurement of incentive pay simpler than in the case of, say, executives, or even other sales force contexts. Moreover, executive pay contracts tend to be customized to individual agents, whereas pay schemes for industrial salespeople are designed at the level of a sales force (or a sales-tier within it) and offered on a take-it-or-leave-it basis (John and Weitz 1989; Lo et al. 2011). Thus sales people within the same tier are paid according to the same scheme. The level of pricing authority, on the other hand, is conferred at the individual sales-person level. The implication of these features of our empirical setting is that even though firms may eventually co-determine both the level of price delegation approved for an individual sales person and their compensation scheme, price delegation in the short run is likely to be affected by compensation scheme, while the reverse is unlikely.[1]

We rely on this information about the industrial sales context, obtained from interviews with sales executives in these firms, to develop a simple model of delegation where task and agent characteristics and compensation schemes are predetermined at the time of the delegation

[1] This is in contrast to Prendergast (2002). In his model, "uncertainty affects the responsibilities offered to workers, which in turn affects incentives" (p. 1075). We come back to this issue further below.

decision. We then use individual sales-person level data on compensation and pricing authority, collected via survey from a sample of 261 firms, to examine the factors that affect the level of delegation (pricing authority) accorded to a particular sales person in each of those firms and its relationship with performance-based pay.

First and foremost, we find a strong positive relationship between the extent of pricing authority and incentive pay, as expected and predicted by theory. This is an important result as it confirms the fundamental complementarity of delegation and incentive pay in dealing with agent bias or potential for shirking.

Second, consistent with the idea that firms need to delegate decisions when adaptation to the local environment is more important (e.g., Holmstrom 1984; Lal 1996; Aghion and Tirole 1997; Dessein 2002; Prendergast 2002), we find a positive relationship between the extent of asymmetric information – captured by measures of monitoring difficulty, customer heterogeneity, and the need for speedy response to competing bids (competitive pressure) – and the extent of price delegation. This effect is consistent with evidence in Hansen, Joseph, and Krafft (2008) and in Frenzen et al. (2010), both of which used perceptual measures of delegation.[2]

Third, we find strong evidence that sales people with longer tenure at their company are given more pricing authority. We view longer tenure as an indication of a higher level of fit between the firm and the sales person, or a tendency for the salesperson's utility to be better aligned with the goals of the principal (i.e. lower bias).

[2] A few authors have considered other delegation decisions, notably in the context of technology adoption (Acemoglu et al. 2007), information-technology (McElheran 2010), newspaper editorial responsibilities (Wu 2011), international trade (Marin and Verdier 2010; Guadelupe and Wulf 2010), personnel management (Moer 2006), and intra-firm hierarchies (Abernethy, Bouwens, and van Lent 2004; Rajan and Wulf 2006). None of these papers consider the role of pay-for-performance as a factor potentially influencing or influenced by delegation. A few other authors examine the allocation of control or decision rights in inter-firm contracts, namely in technology alliances (Lerner and Merges 1998; Ryall and Sampson 2009) and in car dealership agreements (Arrunãda, Garicano, and Vázquez 2001).

Finally, we find that the positive effect of information asymmetry (as measured by customer heterogeneity, competition, and/or monitoring costs) on price delegation is increasing in tenure, suggesting that firms give more experienced sales people higher pricing authority to deal with issues related to information asymmetry. Similarly, the positive effect of customer heterogeneity on price delegation is increasing in incentive pay. In other words, firms give more pricing authority to their sales people when asymmetric information problems are important *and* the agent is highly incentivized.

The paper is organized as follows. In the next section, we discuss in more detail features of the industrial equipment sales context. In Section 3 we present our simple model. We describe our data collection process, and the measures used in our empirical analyses, in Section 4. We present results in Section 5, and conclude in Section 6.

2. INDUSTRIAL EQUIPMENT SALES

We focus our research context on industrial equipment manufacturers who sell capital equipment and machines that are used by their customers in their own production, operations or administrative processes. This equipment is often very complex, reflecting a combination of scientific, engineering, and software technologies that can change in important ways and relatively frequently. More often than not, the equipment needs to be matched with, and tailored to, the specific needs of the customers. The assessment of the customer's needs often requires long periods of interaction between the manufacturer's sales person and the customer's agents. The complexity of the technical knowledge, the pace of technical change, and the variation in customer needs combine to create a challenging environment for those sales people involved in industrial equipment sales.

The sales process for industrial equipment has two other features that distinguish it from most other markets. First, potential customers usually provide detailed project specifications

and source their equipment via "requests for quotations." The quantities specified in these requests for quotations are usually fixed, meaning that the customer sets quantities in advance. Thus we can treat customers as having something akin to unit demand. Second, the deliberate nature of the sales process, which can take months to complete, requires that the sales person demonstrate skills in all aspects of the sale (i.e. technical specification design and customization, discussions and relationship-building with multiple contacts and units of the customer, price negotiation, and so on) and apportion effort to these individual components of the sales process. Obviously, firms provide technical and sales training as well as in-house support (e.g., the sales person can request the assistance of an in-house technical design engineer to solve a vexing specification problem for a particular customer) to aid the sales process.

In part because of this complexity and the length of the sales cycle, compensation plans for these sales people are usually composed of just a fixed salary and a sales-based commission. As in many other sales contexts, the main metric used to calculate commission is the revenue generated by an individual sales person. Managers indicated that the key reason for using revenues rather than gross or net margins is that revenues are easier to observe and less likely to be distorted, or, as one manager stated, "margins can be easily manipulated … the salesperson would not know if he is cheated on and worse he would never believe he is not cheated on … we don't want such headaches." Further, in many cases the equipment sold by these sales people not only requires significant modifications to fit a customer's requirements but also extensive post-sales installation and technical consulting and advisory information from the vendor to bring the equipment "on-line" with the rest of the operations. Computing margins becomes even more difficult in these circumstances. In essence, revenue-based

incentives are popular for sales people in these industries because of their ease of implementation (see also Albers 1996, p.5).

The managers also indicated that to the best of their knowledge, the commission component of the compensation is almost always linear, i.e. a simple proportion of sales. They attributed the tendency to use fixed percentage commission, rather than increasing or decreasing schedules, to both long product sales cycles and unitary demand, where the latter implies that incentivizing customers to buy more (to make a quota at the end of a pay period, for example) is not a relevant feature of these capital goods markets. Long sales cycles for their part mean that many potential sales prospects can spill over from one fiscal period to the next, which would create problems of attribution - to the year when the sale was initiated or concluded - if the firms used non-linear commission plans.

Discussions with managers also revealed that quota-based bonuses are uncommon in this sector, contrary to other contexts.[3] When used, they represent only a small component of the sales person's total compensation for the year, typically no more than 5%. Moreover, in many cases, bonuses are provided in kind – e.g. an all-paid vacation for the family – rather than cash, in which case they never appear in our compensation data. Quotas may be used as well. These would be set at the start of the fiscal year based on a variety of considerations, including territory potential, competitive intensity, sales person tenure, past performance, and so on. Firms rarely penalize a sales person for missing his or her quota for a year or two. This is to account for the long sales cycles – sales people can go for months without making a single sale. However, missing ones' quota consistently over a longer horizon of time might lead to some

[3] See notably Joseph and Kalwani (1998) and more recently Misra and Nair (2011) on the use of quotas in other contexts.

interventions, for example, more managerial supervision of the call plans and processes or termination.

Finally, as mentioned in the introduction, and in contrast to executive compensation schemes that tend to be individualized, sales people usually are paid based on pay plans devised at the level of the whole sales force or sales group. More precisely, sales people within a particular group/tier, selling similar products to customers with similar profiles, are offered the same compensation plan, albeit one where the fixed component may be adjusted for cost of living and/or travel to office "dearness" allowances. The intensity of incentives is not adjusted or tailored to individual sales persons characteristics. The level of pricing authority, on the other hand, or the maximum percentage discount off the list price that the sales person can offer a buyer without conferring with his manager, is accorded to a sales person after they join the firm and it can change over time. Our interviewee-managers indicated that the primary role of the pricing authority accorded to the sales person was to enable them to tailor the price to the particular situation of a given customer, i.e. implement some level of price discrimination. List prices, on the other hand, are typically the same across all sales territories, and modified only infrequently, so as to maintain a consistent perceived value (or "street price") for the products.

Sales force managers also indicated that allowing their sales people to offer price discounts does not lead sales persons to "automatically" drop price to encourage the sale (i.e. substitute price discounts for effort). They said that both compensation and supervision curb this tendency. In particular, since their own commission revenue is based on the revenues generated from a sale, sales people are cautious about discounting. In addition, if the managers notice a repeated pattern of high discounts suggesting overuse of the sales person's discretionary authority, they bring this up with the sales person and make suggestions (including regular sales training exercises) on how the situation could be handled better from the company's point of view. Such

counseling sessions make the sales person aware that he is exercising his discretionary limits too often.

3. DELEGATION AND PAY-FOR-PERFORMANCE – A SIMPLE MODEL

We adapt a model from Dessein (2002) to generate empirical implications that we bring to the data below. Other theoretical frameworks (e.g. Prendergast 2002; Brickley et al. 2009) also have proved useful in studying the link between delegation and performance pay. We revisit implications from these models in our discussion of results below. However, the setup of the model we present conforms to our institutional context well, and thus its implications provide useful guidance for our empirical analyses.

Consider an employer or firm (the principal/she), who produces an industrial good (equipment) with a production cost of c, and employs sales people to sell its product. In what follows, we focus on the firm's problem regarding a single sales person (the agent/he). This sales person is assigned to a segment of N customers that the firm targets. For now, we assume this sales agent is paid a fixed salary, W.

Consistent with the features of the industry, we assume that all customers have a predetermined bundle of goods they want to purchase, and that they put out requests for proposals and buy from the seller with the most competitive offer. To keep things tractable, we assume that each customer buys a single unit of the product, but since customers may use the equipment in different ways, the value to them differs. We assume that this value is drawn from a continuous uniform distribution over $[v_L, v_H]$. Because he interacts with the customers directly, the sales person can learn customer needs and valuation, but the firm only knows the overall distribution of customer values.

For simplicity, we model the decision to delegate or not, rather than how much pricing authority to delegate. In other words, in our simple model, the agent or the firm chooses price,

whereas in our empirical analyses, we examine how much pricing authority the sales person is given. Also, given the observed timing of decisions, we assume that the firm decides whether to delegate pricing to its sales person *before* the latter learns customer valuations,[4] and that the principal is committed to this delegation decision.[5]

Under delegation, we assume that the sales agent has full pricing authority. His interactions with customers allow him to correctly perceive the value of the firm's product to each customer. However, the process of customer valuation discovery requires effort on the part of the sales agent.[6] Because he is paid a fixed wage, he may put in only that amount of effort that allows him to obtain good enough, but still imperfect information about each customer's valuation (Stephenson, Cron, and Frazier 1979, p.26). In order to still achieve all sales, he must then price conservatively, such that he loses on average an amount b per customer (see Dessein, 2002) relative to the case where he assesses values fully and charges accordingly. Alternatively, b could represent the sales person's tendency to take advantage of the perks that the firm intends for customers (e.g., nice meals, travel, and other forms of entertainment). In either case, we model these behaviors by assuming that the industrial equipment manufacturer obtains revenues of $(v_i - b)$ from each customer $i = 1, 2, \ldots, N$. We assume that shirking or taking perks is associated with a reputation cost for the agent, which we take to be convex in b and N. Specifically we assume this cost equals $\frac{\beta(bN)^2}{2}$, where β is the weight that the agent

[4] We could allow the agent to communicate messages about customer valuation to the firm. Nevertheless, the firm always prefers delegation to communication under the assumption of uniform distribution, and thus communication never appears in our analysis. See, for instance, Crawford and Sobel (1978), Dessein (2002), and Alonso, Dessein, and Matouschek (2008) for models where communication is useful.

[5] Commitment is possible under self-enforcing relational contracts (Baker, Gibbons, and Murphy 1999), which fits our context since the sales persons in our sample are in long-term employment relationships with their employer. The average tenure of the sales people in our data is over four years. In reality, reneging on, or changing the level of pricing authority would be disruptive and costly. Occasionally, however, firms do take such actions with respect to a particular sales person.

[6] For simplicity, we subsume all forms of agent effort in what we refer to as customer valuation assessment.

puts on this cost in his utility function, which we assume is larger than one. In other words, β is an agent characteristic such that higher β's are associated with greater agent sensitivity to this reputation cost.

The agent thus chooses the level of b that maximizes his utility U, given by his total compensation minus the cost of b, namely

$$U=W+bN-\frac{\beta(bN)^2}{2},$$

which yields $b^*=\frac{1}{\beta N}$. Under delegation, then, the principal obtains from each customer what amounts to the average value of the product to customers minus b^*. The principal's profits are

$$\Pi^D = N\left(\frac{v_L+v_H}{2}-\frac{1}{\beta N}-c\right)-W$$

where $\frac{v_L+v_H}{2}$ represents the average price paid by customers in the case where the sales agent "consumes" $\frac{1}{\beta N}$ in extra expenditures or perks, or $\frac{v_L+v_H}{2}-\frac{1}{\beta N}$ represents the amount that the firm receives on average if agent bias is associated with low effort put toward the assessment of customer values. In the above profit function, W is agent salary, and c again stands for production costs. To ensure that it is efficient for the firm to serve all customers, we assume that the lowest customer valuation is sufficiently larger than the production cost. Specifically, we assume $v_L > c + 1$, since the largest possible equilibrium value of agent bias is 1.[7]

[7] Note that $b^*=\frac{1}{\beta N}$ with $\beta \geq 1$ and $N \geq 1$. The agent's wage, W, is a fixed cost in our model so it does not affect the firm's short-run decision.

Under centralization, the firm sets price. Since it only knows the distribution of customer valuations, it is unable to price discriminate. It therefore sets price to maximize

$$N(p-c)\left(\frac{v_H - p}{v_H - v_L}\right),$$

where $\frac{v_H - p}{v_H - v_L}$ is the proportion of customers who buy at price p. This maximization yields

$p^C = \frac{v_H + c}{2}$, so that profits for the principal are

$$\Pi^C = N\frac{(v_H - c)^2}{4(v_H - v_L)} - W.$$

The decision to delegate or not is based on a comparison of Π^C and Π^D, i.e. the firm chooses to delegate if

$$\frac{v_H + v_L}{2} - \frac{1}{\beta N} - c > \frac{(v_H - c)^2}{4(v_H - v_L)}.$$

This comparison yields two predictions that we take to the data below. First, since the amount of shirking or perks-taking reduces profits under delegation, the likelihood of delegation decreases with increases in agent bias (decreases in β). Second, it can be shown (see appendix) that everything else the same, an increase in v_H has a positive effect on $\Pi^D - \Pi^C$. This is because for fixed v_L, an increase in v_H implies more variance (and higher average customer value as well). This in turn makes the information that the agent garners more valuable, and thus increases the likelihood of delegation.

Finally, the model above assumes that agent compensation consists of a simple fixed wage, independent of the decision to delegate or not. We can, however, introduce performance pay, which, as is well known, can help align the interests of an agent to those of his principal. As there is no scope for agent effort to affect outcome under centralization in our simple model,

we continue to assume that the agent is paid a fixed wage of *W*. But under delegation, we now allow the firm to pay a combination of lower fixed wage, *W'*, and commission rate, α, calculated on sales revenues, to the sales person. To focus on the incentive aspect of commission, we assume that the agent is risk neutral.[8] The sales person chooses *b* to maximize his utility, now given by

$$U = W' + bN + \alpha N\left(\frac{v_L + v_H}{2} - b\right) - \frac{\beta(bN)^2}{2},$$

under delegation. This maximization yields $b' = \frac{1-\alpha}{\beta N} < b^* = \frac{1}{\beta N}$, such that b' is smaller the larger the commission rate is. In other words, the effect of paying commission to sales agent is equivalent to reducing their bias (decreasing β). Thus, as in Dessein (2002), our simple model predicts that the firm is more likely to delegate pricing authority if it pays a higher level of commission on sales as commission rates reduce *effective* agent bias. We assess this last prediction from our model in our analyses below as well.

4. DATA AND MEASUREMENT

An empirical analysis of firm decisions to delegate pricing authority, and of the relationship between such delegation and the commission rates offered to sales people, requires data not only on an individual sales-person's pricing authority and compensation but also variation on key task and agent characteristics. Such data are unlikely to be available in public records. Hence, we obtained our data via a proprietary mail survey administered to sales managers in firms manufacturing durable industrial equipment and selling it through direct sales forces (though not necessarily exclusively so). We sampled firms from four major industrial equipment manufacturing sectors, namely, non-electrical machinery including computer

[8] We also assume that there are reasons outside our model (e.g., sales person's wealth constraint, or the potential for the behavior of an agent to affect outcomes for other agents) such that the firm does not choose to sell the distribution rights for the territory to the sales person.

equipment (SIC 35), electrical and electronic machinery (SIC 36), transportation equipment (SIC 37), and instruments (SIC 38). To ensure data quality, a number of steps were taken, including (1) detailed pilot interviews with field sales managers to ascertain the relevance of our issues to their sales contexts, (2) choosing the appropriate survey participants, and (3) constructing appropriate measures of our variables. These steps are described below.

4.1. Pilot Interviews

To better understand the issues firms face in choosing the extent of pricing authority they grant to individual sales people and designing compensation plans for them, we conducted on-site field interviews with sales managers at 16 firms. Each interviewee was directly responsible for managing the firm's direct sales force, either at the regional or national level. These interviews lasted for an average of about 3 hours each. We also pre-tested our survey instrument during some of these interviews. Insights from this pilot study were then used to refine the questionnaire and generate the final survey instrument. In addition, these interviews were the source of much of the information regarding how managers choose the level of pricing authority and the compensation plans of their sales people discussed in Section 2.

4.2. Selection of Survey Participants and Data Collection Procedure

To obtain quality measures of our key variables, we used a two-stage procedure to reach our survey participants. We first obtained a list of sales managers of manufacturing firms with sales exceeding $100 million in the relevant industrial sectors from two list brokers – the American List Council and Dunn and Bradstreet. The 1470 individuals on these lists were then contacted by phone. To qualify as key informants, they had to meet two criteria: they had to be primarily involved in managing the sales force for their division/firm in a well-defined customer, product, or geographic market; and their firm had to be using a direct sales force rather than contract dealers in those markets. Four telephone calls on average were required to

qualify each informant. To elicit cooperation, we offered each manager a customized report summarizing the findings from our survey and comparing their profile to the average patterns in the data. Of the initial 1470 individuals, 869 indicated that they use a direct sales force. In the second stage, we mailed questionnaires to each of these 869 respondents. After two reminders, we had obtained 264 responses. Three of these were discarded for missing data, for a final sample of 261 responses (or a response rate of 30%).

The survey questions were designed to be specific to a particular sales person that these sales managers were currently supervising. To minimize selection bias on the sales person, we asked the sales manager to identify a customer who had procured their company's product over the previous fiscal year (2005) and then identify the sales person who was responsible for making that particular sale. We then requested that the manager give responses pertaining to this and only this sales person. Hence, our unit of analysis is an individual sales person, with each sales person, or data point, representing a product or product line in a different firm.[9]

4.3. Variables and Measurement

In this section, we describe the measure we use for our main dependent variable of interest, namely price delegation. We also describe measures for our main explanatory variables, namely the commission rate, agent bias and asymmetry of information, all of which our model suggests should affect the extent of price delegation. While some of our measures are cardinal (e.g. extent of delegation, firm size), many others are ordinal, obtained using 7-point Likert scales (e.g. monitoring difficulty and customer heterogeneity).

[9] Given our survey procedure, it is possible that informants systematically chose, e.g. their best customers and/or sales agents to report on. To address this, we assessed two customer-side measures – the profitability of the customer to the firm and the firm's satisfaction with this customer relationship – as well as one sales person characteristic, namely their tenure at the company, for distribution bias. The data exhibited large variation along all these measures, suggesting that the manager-informants did not systematically choose to report on their most profitable customers or their most senior sales people.

Price Delegation: Each manager was asked to report the percentage of price discount off the list price that the sales person is allowed to offer customers without conferring with his manager. Hence, higher percentages mean that the sales person has more discretion when making price offers to customers.[10] We find it noteworthy that our measure of delegation is cardinal, as opposed to the perceptual or dichotomous measures that have been used in prior studies (Wulf 2007; Nagar 2002; Foss and Laursen 2005; Frenzen et al. 2010). Figure 1 shows that there is substantial variation in the amount of pricing authority afforded sales people in our data.

Compensation: For each sales person, we obtained measures of their salary and total compensation in the year prior to the survey, as well as the sales they generated during that year. *Base Salary* is the dollar amount of fixed compensation received by the sales person in the previous fiscal year. *Total Compensation* refers to the sum of the base salary and performance-based compensation (e.g., bonus and commissions) received in the same fiscal year. In our data, the proportion of performance-based to total compensation is about 30%, similar to the 29% ratio in John and Weitz (1989), but somewhat lower than Zoltner et al. (2006, p.2)'s estimate of around 40% for a typical sales person in the U.S.

We calculate the commission rate as:

$$\textit{Commission Rate} = (\textit{Total Compensation} - \textit{Base Salary})/\textit{Sales Revenue}$$

where, *Sales Revenue* is the amount of sales generated by the sales person in the same fiscal year, also in US dollars.[11] In the presence of any commission payments that would not be sales based (e.g., payments based on the number of newly acquired customers), our measure would

[10] As mentioned earlier, industrial equipment manufacturers set list prices to be consistent across all sales territories, and they modify these only infrequently, so as to maintain consistent perceived value for their products. As a result, differences in the level of authorized discounts across salespeople within a firm represent real differences in the level of delegation across these individuals.

[11] Unfortunately, we were not able to collect data on the commission rate directly.

overestimate the true marginal incentives. If bonuses are paid for achieving particular sales quotas, on the other hand, our measure has the advantage of capturing the average contribution of increased sales on the expected amount of bonuses paid. Since managers indicated that sales-based commission payments comprise the vast majority of their sales force' incentive pay, with bonuses representing at most 5% of total pay, we view our measure of *Commission Rate* as a good first-order approximation for sales-based performance pay.[12] We briefly revisit these measurement issues in discussing our results, in Section 5.

Asymmetric Information: We used 7-point Likert scales to measure how difficult the sales person's activities are to supervise (*Monitoring Difficulty*) and the heterogeneity of customer usage of their products (*Customer Heterogeneity*). We use both of these variables to capture the informational advantage of the sales person over the firm, which our model implies should positively affect delegation. Respondents also told us how many direct competitors they faced in the relevant product category (*Number of Competitors*). We were told that the intensity of competition affects the bargaining power of industrial equipment buyers and the required speed of response to competing bids, both of which should increase the value of local information and thus, presumably, increase the value of delegation.[13]

Agent Bias: We have information on the number of years that the particular sales person has worked with the company (*Sales Person' Tenure*). We use this information to capture (the inverse of) agent bias. In other words, we assume that longer tenure implies a better match

[12] If firms used accelerating commission rates (as in, e.g., Lal and Srinivasan 1993, p.783; Joseph and Kalwani 1998; Oyer 1998, 2000; Larkin 2007), our measure would *underestimate* the true incentive intensity at the margin. But as mentioned in Section 2, we were told that such increasing scales are rarely used in these industries because of the long duration of the sales process.

[13] In principle, a higher number of competitors would be expected to lead to lower manufacturers' *list prices,* which would reduce margins and thus the extent to which prices can be discounted. However, as we described in the introduction, industrial equipment and products can be very complex and are usually sold in a bundle, with other services and accessories. As such, they remain differentiated. In that context, the effect of competition on how much leeway the firm gives its sales people to *discount prices* may yet be positive, as described by our respondents.

between the firm's goals and agent actions and hence a lower tendency for the agent to behave in ways that the firm finds objectionable.

In addition to the variables above, we control for a number of other characteristics of the firm and agent in all our analyses. In particular, we include *Firm Size*, measured by sales revenues in the previous year, and *Firm Reputation*, measured via a 7-point Likert scale on the quality of the firm's products and services. We also control for the sales person's risk preferences (*Sales Person's Risk Aversion*) and ability (*Sales Person's Ability*), both of which are assessed by the sales person's manager at the firm. We further include measures of the turbulence of the environment, which may also affect the firm's desire to delegate authority to its sales people. Prendergast's (2002) model, for example, implies that firms will want to delegate more when there is more uncertainty in the environment. However, if this uncertainty is not actionable by the agent, other models suggest the opposite should occur (e.g. Williamson, 1985). We remain agnostic as to their expected effects, but we include measures of uncertainty arising from the pace of product/equipment obsolescence (*Rapid Technological Change*) and uncertainty of product demand at the industry level (*Industry Demand Uncertainty*) in our delegation equation.

The questions used to elicit the above information are all listed in Table 1. Summary statistics for all the variables are shown in Table 2.

5. EMPIRICAL SPECIFICATION AND RESULTS

Our goal is to examine the determinants of the extent of delegation of pricing authority and assess the relationship between the delegation decision and the compensation scheme. Taking the facts of the industry as described in Section 2, we argue in what follows that in the short run, compensation is predetermined when the delegation decision is made, and thus that delegation will be affected by compensation rather than the other way around. Because of the

cross-sectional and between-firm nature of our data, however, we are limited in what we can do empirically with regard to causality. For that reason, our evidence also may be viewed in terms of characterizing simple relationships among important decisions rather than establishing causal effects.

5.1. Econometric Specification

As described earlier, the compensation plan for sales persons is usually set *at the time* of employment and is the same for all the individuals engaged in the same type of sales job within the firm. The delegation of pricing authority in industrial sales forces, in contrast, is more often conferred to sales people by their managers *after* an individual sales person has started his/her job, and further modified when appropriate in the course of one's career within the firm. These facts suggest that the commission rate can be taken as pre-determined in our econometric specifications, that is, we can write: [14]

$$\text{Log}(\textit{Price Delegation}_i) = \zeta\, \textit{Commission Rate}_i + x_i'\gamma + \varepsilon_i,$$

where i denotes the sales person (and implicitly the firm, as we have data relating to one sales person per firm), and x_i is a vector of explanatory variables, including industry fixed effects. We use the (natural) log of price delegation as our dependent variable as this specification yields well-behaved error terms. We introduce most of our explanatory variables linearly as most of them are indices with limited variation, but we use the (natural) log of *Firm Size*, *Competition*, and *Tenure* to reduce the effect of outliers.

In our cross-sectional setting, the consistency of our estimated coefficients in our delegation regressions – and in particular the consistency of the commission rate parameter – depends on

[14] Our estimation equation is different from that suggested by Prendergast (2002)'s model, where delegation would explain the commission rate. His rationale is that an uncertain environment leads to greater levels of delegation, which in turn affects the desired level of incentives the firm wants to offer its agent. While we view the setting of our analyses as one where causality is likely reversed, our evidence demonstrates the alignment between delegation and compensation, and in terms of that relationship, our results are consistent with the implications of Prendergast (2002)'s model as well.

whether we have included a sufficient number of explanatory and control variables to avoid biases arising in particular from omitted variables. In particular, since the *Commission Rate* also is set as a function of many of the same factors that we expect will affect delegation decisions, some of which may be unobserved by the econometrician, we begin our empirical analyses by examining the determinants of the commission rate. Specifically, we estimate

$$Commission\ Rate_i = x_i'\delta + u_i,$$

focusing first on the effects of the many task/firm characteristics that we expect to affect this decision, along with base salary. We then include variables related to agent characteristics in column 2.

Results, in Table 3, confirm that commission rates are associated with several job and agent characteristics, as one would expect from both theory and empirical analyses of performance pay schemes (e.g., Lazear 2000; Ackerberg and Botticini 2002; Lo et al. 2011). First, we find that firms trade off base salary and commission, as predicted by most models of sales force compensation. It is reassuring to find this effect in our cross-sectional setting. Second, larger firms offer higher commission rates. This may be a monitoring issue, or related to the well-known firm-size effect on pay. Third, firms with more reputable products tend to rely less on commission pay, presumably because agent effort is less valuable for them. Finally, and consistent with agency arguments, we find that the commission rates are higher in environments where customers have more heterogeneous valuations and needs, but lower when the environment is volatile in ways that the agent has no control over (i.e. *Rapid Technological Change* and *Industry Demand Uncertainty)*.

As for agent characteristics, in Column 2, we find that agents who are perceived as more risk averse work under lower-powered compensation schemes whereas those who are perceived as more able work under higher-powered compensation schemes on average. Also, the effects

of technological innovation and firm reputation are reduced to the point that they become statistically insignificant. Lo et al (2011) argue that this result obtains because agents self-select into jobs and compensation schemes that fit their characteristics. Lastly, consistent with information regarding how commission rates are set at the sales force level, we find that the sales person's tenure does not have a significant effect on the commission rate.

Having established the factors that affect the setting of commission rates, we begin our empirical analyses of price delegation by examining the effect of asymmetric information and agent bias without controlling for commission rate (column 1 of Table 4). We then show the effect of including the commission rate among the regressors in column 2, and the effect of further adding base salary in column 3. Moreover, although our model did not rely on functional forms that would yield interaction terms, it is possible that the extent of asymmetric information becomes more potent as a factor leading to delegation when (i) agent bias is lower and (ii) the compensation scheme involves higher-powered incentives. We explore these possibilities in columns 4 and 5 respectively. Specifically, we include interaction terms between our measures for asymmetric information – customer heterogeneity, monitoring difficulty, and competition – and sales person tenure in column 4. In column 5, we further include interaction terms between the same three measures of asymmetric information and the sales person's commission rate.

The results across all these specifications are quite consistent, even though the presence of interaction terms in columns 4 and 5 makes it harder to interpret some of the direct effects of the variables that we interact. First and foremost, in line with the predictions of our model, we find that the effect of *Commission Rate* on price delegation is positive and significant. Because of the semi-log specification, the coefficient of 0.121 in column 2 implies that an increase of one percentage point in the commission rate (from say 3 percent to 4 percent) leads to an

increase of 12 percent in the maximum price discount (from say 10% off the list price to 11.2%) that a sales person can offer his/her customers.[15] In other words, sales people receiving more performance pay – because the firm/task characteristics warrant it, per Table 3 – are also more likely to be given more pricing authority. When we incorporate the interaction of commission rate with our three measures of asymmetric information, the direct effect of commission rate becomes statistically insignificant. The marginal effect taken at the means of customer heterogeneity, monitoring difficulty, and natural log(competition), however, is even larger, at 0.151 percentage points (= –0.083 + 0.058×3.67 – 0.014×3.74 + 0.032×log(9.96)). Moreover, while the effect of the interaction terms with competition and monitoring difficulty is insignificant, the interaction term with customer heterogeneity has a sizable positive coefficient. Put together, these results suggest that when commission rates are set at higher levels, firms delegate more pricing authority, and they do so even more when asymmetric information problems – especially those related to heterogeneous customers – are more severe.

Second, we find that the inclusion of the commission rate in columns 2 and 3 does not affect the coefficients of our measures of asymmetric information or agent bias much at all. On the other hand, although the signs remain unaffected, the effects of agent ability and risk aversion, as well as firm size, all of which were highly correlated with the commission rate in Table 3, become statistically insignificant when we control for the commission rate directly in column 2. In other words, the effect of these variables on delegation operates most importantly through the choice of commission rate (see Lo et al. 2011 for more on this; also see Brown 1990).

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[15] Given our semi-log functional form, the coefficient equals $\frac{\partial(\textit{Price Delegation}) / \textit{Price Delegation}}{\partial(\textit{Commission Rate})}$, i.e., the ratio of the proportional change in price delegation to the level change in commission rate.

Third, also consistent with the predictions of our model, in the regressions with no interaction terms, in columns 1 to 3, we find that managers delegate more pricing authority to their sales people when there is asymmetric information, that is when monitoring sales people is costly (*Monitoring Difficulty*) and there is greater *Customer Heterogeneity*, though the latter effect is not measured with enough precision to be statistically significant. As for the number of competitors, consistent with our interviewees' contention that it forces the firm to improve the sales person's responsiveness to customer-specific conditions, we find a large positive effect of this variable on the extent of delegation. Although the coefficients of these variables undergo large changes when interaction terms are included in columns 4 and 5, their marginal effects at the means of other variables are positive in these regressions still. [16]

Fourth, in terms of agent bias, we find that a sales person's tenure – an inverse measure of agent bias – is positively related to price delegation in columns 1 and 2, a result that is consistent with predictions of our simple model. In addition, it is noteworthy that in both columns 4 and 5 the coefficients of the interaction terms between the three measures of asymmetric information – customer heterogeneity, monitoring difficulty, and competition – and (the inverse of) agent bias, captured by tenure, have the expected positive signs. In other words, we find evidence that the effect of increased information asymmetry on delegation is larger when agent bias is low. Similarly, in column 5, we find that asymmetric information – especially customer heterogeneity – has a greater effect on delegation for those agents who are paid higher commission rates. The direct effect of tenure becomes negative when we include interaction terms in columns 4 and 5, but the marginal effect of tenure at the means remains

[16] The direct effects of all three measures of asymmetric information become insignificant in column 4. When we further add interaction terms involving the commission rate, in column 5, the direct effect of customer heterogeneity becomes negative and significant. One can verify that the marginal effects of these variables evaluated at means remain positive. For example, in column 5, at the mean of the (log of) tenure and commission rate, however, the marginal effect of customer heterogeneity remains positive: $0.026 = -0.198 + 0.061 \times \log(4.07) + 0.058 \times 2.39$.

positive there as well. [17] In sum, we find that the combination of asymmetric information with low enough bias, and/or high commission, leads to more delegation.

Finally, we find that base salary is positively related to delegation, suggesting that agent characteristics that lead to higher pay (both commission and base salary) also induce managers to grant greater amounts of discretion on price.

We conducted a number of robustness analyses to address (i) issues of functional form, and (ii) the possibility that our measure of commission rate overstates the true marginal incentives of the agents because the variable component of pay in our data might include some (limited) bonus payments. We found that results were the same if we used the level of price delegation rather than its natural log as our dependent variable, and when we used a log-log specification as well. Similarly, our results were unaffected when we calculated the commission rate as the remainder of variable pay over revenues after removing either 2.5% or 5% of the sales people's total compensation, under the assumption that this part of the variable pay might represent bonuses. We chose these percentages as managers indicated that 5% would probably be the most amount of bonus pay these sales people would get.

6. CONCLUSION

Despite considerable theoretical interest in delegation or decision rights allocation and its relationship with incentive pay, evidence regarding these decisions remains scarce. Using a data set on individual sales person compensation and delegation data in the context of industrial equipment sales, this paper investigates the determinants of price delegation given to sales people by their business-unit/divisional managers, and the relationship between the power of incentives in their compensation scheme and this pricing authority. Our context and data are

[17] For example, in column 4, its marginal equals $0.185 = -0.491 + 0.043\times3.67 + 0.090\times3.74 + 0.083\times\log(8.96)$. A similar result is found in column 5.

appealing to investigate these issues since the delegation of pricing authority and pay-for-performance, in the form of commission on sales, are common in these settings.

We find strong support for the predictions of our model in our data. On the one hand, sales agents are given more pricing authority when their activities are difficult to monitor, when they face more heterogeneous customers, and/or more intense competition, all of which increase the value of local, or intensity of asymmetric, information between the firm and its agent. Agents also are given more pricing authority when they have been with the firm longer, which we interpret as an indication of lower agent bias. Moreover, the positive effect of the interaction of local information advantage and tenure suggests that delegation is especially valuable when agent bias is low and information is more asymmetric. We also found evidence that pay-for-performance, or the commission rate, is positively related to delegation. In other words, these two features of organizational design are complementary, as suggested by our model (see also Dessein 2002). Moreover, the positive effect of the interaction of commission rate and asymmetric information variables suggests that as local information becomes more important, firms delegate even more if their sales people work under more incentivized pay schemes.

While consistent with the implications of our simple model, many of the empirical results mentioned here are also consistent with Prendergast's (2002) model of delegation and incentive provision. Given that commission rates are not tailored to the individual in our setting, while delegation is, the timing of decisions is different from that assumed by Prendergast, whose model may be better suited to the study of executive compensation, for example. Nonetheless, the positive correlation we found between incentives and delegation is consistent with his model in that it shows that these decisions are interconnected. This idea, that compensation scheme and delegation are fundamentally related decisions can be traced back at least to Jensen

and Meckling (1992) (see also Brickley et al. 2009, Ch.11). We therefore view our empirical results as supportive not only of our model, but also of this class of arguments generally.

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FIGURE 1: THE EXTENT OF PRICING DELEGATION

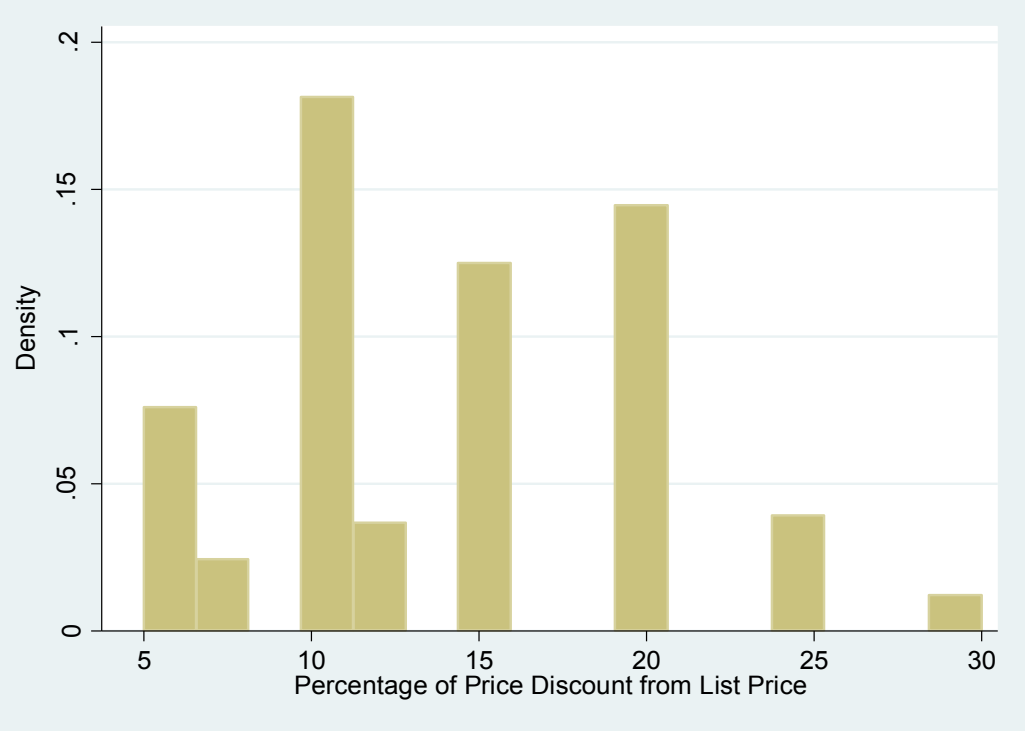

TABLE 1: DESCRIPTION OF VARIABLES

Price Delegation	This sales person has authority to offer customers price discounts of up to ___ % off the list price without conferring with his/her supervisors.
Monitoring Difficulty†	It is not possible to supervise the sales person's activities closely.
Customer Heterogeneity†	Our product can be used in manufacturing / administrative / operational activities that vary widely from customer to customer.
Competition	What is the number of competitors for this product-line/equipment?
Firm Size	Total firm or SBU revenues for the year (sales revenue in US dollar millions)
Firm Reputation†	Our company has a good standing in the business world for providing quality products and services.
Product Complexity†	The inter-linkages between different components and sub-systems in our product are very sophisticated.
Rapid Technological Change†	The machine/equipment in this product category becomes obsolete very fast.
Industry Demand Uncertainty†	The total demand in this product category is very predictable (reverse coded).
Sales Person's Tenure	Number of years this sales person has been working in your company.
Sales person's Ability†	This sales person has a high degree of competence in tailoring his/her sales approach to the specific situation on hand.
Sales Person's Risk Aversion†	In my opinion, this sales person would be willing to sacrifice some "top-end" variable pay to assure himself/herself of a steady compensation (i.e. base salary).
Base Salary	What was the total fixed compensation (i.e. base salary) that was received by this sales person in the last fiscal year?
Total Compensation	What was the total compensation (base salary plus performance based compensation - commissions, quotas etc.- that is based on a fixed formulae) received by this sales person in the last fiscal year?
Sales Generated by Sales Person	What was the total revenue, in million US dollars, generated by this sales person in the last fiscal year?

†Measured using 7-point Likert scales (1= totally disagree; 7= totally agree)

TABLE 2: DESCRIPTIVE STATISTICS

Variables	Mean	St. Deviation	Minimum	Maximum
Price Delegation[#]	13.98	6.04	5	30
Monitoring Difficulty	3.74	1.24	1	6
Customer Heterogeneity	3.67	1.54	1	7
Competition[#]	8.96	4.84	2	40
Firm Size[#**]	1627.7	5915.5	102	83000
Firm Reputation	4.18	1.49	1	7
Rapid Technological Change	3.64	1.57	1	7
Industry Demand Uncertainty	3.36	1.45	1	7
Sales Person's Tenure[#]	4.07	2.66	1	15
Sales Person's Risk Aversion	3.36	1.28	1	7
Sales person's Ability	4.70	1.32	2	7
*Base Salary**	82.6	15.6	52.5	118.5
*Total Compensation**	117.0	21.7	73	170
*Sales Generated by Sales Person**	1707.2	1848.3	580	24000
Commission Rate	2.39	0.97	0	5.16

[#] Summary statistics are in levels. In our econometric models, these variables are in natural log.
* In thousands of dollars.
** In millions of dollars.
Number of observations = 261.

TABLE 3: DETERMINANTS OF COMMISSION RATES

Dependent Variable: *Commission Rate*

	(1)	(2)
Base Salary	-0.029***	-0.029***
	(0.004)	(0.004)
Task/Firm Characteristics		
Monitoring Difficulty	-0.029	-0.083*
	(0.049)	(0.046)
Customer Heterogeneity	0.058*	0.053*
	(0.033)	(0.030)
Rapid Technological Change	-0.081**	-0.049
	(0.040)	(0.041)
Industry Demand Uncertainty	-0.070	-0.047
	(0.044)	(0.040)
Log (*Competition*)	0.141	0.232**
	(0.113)	(0.109)
Log(*Firm Size*)	0.243***	0.189***
	(0.060)	(0.056)
Firm Reputation	-0.074**	-0.098**
	(0.036)	(0.040)
Agent Characteristics		
Log(*Sales Person's Tenure*)		-0.126
		(0.079)
Sales Person's Ability		0.177***
		(0.045)
Sales Person's Risk Aversion		-0.144***
		(0.033)
R^2	0.267	0.360
F-statistic	10.082***	11.673***

Number of observations = 261. All models include industry fixed effects and these fixed effects are significant at 1%. * significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors of coefficient estimates in parentheses.

TABLE 4: DETERMINANTS OF PRICE DELEGATION

Dependent Variable: Log(*Price Delegation*)

Main Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Commission Rate		0.121**	0.150***	0.147***	-0.083
		(0.029)	(0.031)	(0.032)	(0.155)
Customer Heterogeneity	0.020	0.015	0.012	-0.046	-0.198***
	(0.015)	(0.015)	(0.015)	(0.032)	(0.062)
Monitoring Difficulty	0.085***	0.080***	0.096***	-0.015	0.073
	(0.022)	(0.020)	(0.022)	(0.051)	(0.070)
Log (*Competition*)	0.211***	0.184***	0.176***	0.093	-0.000
	(0.056)	(0.053)	(0.054)	(0.099)	(0.165)
Log (*Sales Person's Tenure)*	0.158***	0.158***	0.175***	-0.491*	-0.483**
	(0.045)	(0.043)	(0.044)	(0.213)	(0.235)
Interaction Terms					
Log(*Sales Person's Tenure*) × *Customer Heterogeneity*				0.043*	0.061**
				(0.023)	(0.024)
Log(*Sales Person's Tenure*) × *Monitoring Difficulty*				0.090**	0.068
				(0.041)	(0.044)
Log(*Sales Person's Tenure*) × *Competition*				0.083	0.092
				(0.068)	(0.078)
Commission Rate × *Customer Heterogeneity.*					0.058***
					(0.020)
Commission Rate × *Monitoring Difficulty*					-0.014
					(0.021)
Commission Rate × *Competition*					0.032
					(0.033)
Control Variables					
Base Salary			0.004*	0.006**	0.007***
			(0.002)	(0.002)	(0.002)
Rapid Technological Change	-0.085***	-0.082***	-0.078***	-0.073***	-0.076***
	(0.019)	(0.018)	(0.017)	(0.019)	(0.020)
Industry Demand Uncertainty	-0.028	-0.030*	-0.022	-0.029**	-0.040***
	(0.017)	(0.015)	(0.014)	(0.015)	(0.015)
Log(*Firm Size*)	0.049*	0.038	0.022	0.007	-0.000
	(0.028)	(0.025)	(0.026)	(0.026)	(0.026)
Firm Reputation	-0.034	-0.025	-0.019	-0.007	-0.016
	(0.024)	(0.023)	(0.023)	(0.028)	(0.028)
Sales Person's Ability	0.058**	0.037	0.032	0.030	0.017
	(0.023)	(0.023)	(0.022)	(0.024)	(0.024)
Sales Person's Risk Aversion	-0.046**	-0.026	-0.024	-0.018	-0.017
	(0.018)	(0.018)	(0.018)	(0.020)	(0.021)
R^2	0.331	0.381	0.391	0.417	0.442
F-statistic	16.283***	18.125***	15.849***	16.172***	24.763***

Number of observations = 261. All models include industry fixed effects and these fixed effects are significant at 1%. * significant at 10%; ** significant at 5%; *** significant at 1%.Robust standard errors of coefficient estimates in parentheses.

Appendix

In this appendix, we show that the difference in the principal's profit between delegation and centralization is increasing in v_H. Define

$$\Delta = \left(\frac{v_L + v_H}{2} - \frac{1}{\beta N} - c \right) - \frac{(v_H - c)^2}{4(v_H - v_L)}.$$

The derivative of this term with respect to v_H is

$$\frac{\partial \Delta}{\partial v_H} = \frac{v_H^2 + 2v_L^2 + c^2 - 2(v_H^2 + c)v_L}{4(v_H - v_L)^2}.$$

This expression is monotonically decreasing in *c*: its derivative with respect to *c* equals $\frac{c - v_L}{2(v_H - v_L)^2} < 0$. Nonetheless, $\frac{\partial \Delta}{\partial v_H}$ is positive in the possible range of *c,* $[0, v_L - 1]$. To see this, note that at *c* = 0,

$$\frac{\partial \Delta}{\partial v_H} = \frac{v_H^2 + 2v_L^2 - 2v_H v_L}{4(v_H - v_L)^2} > 0,$$

given that the denominator is clearly positive, the numerator equals $v_H^2 > 0$ when v_H equals its smallest value, v_L, and the numerator is monotonically increasing in v_H .

On the other hand, at $c = v_L - 1$,

$$\frac{\partial \Delta}{\partial v_H} = \frac{v_H^2 + v_L^2 - 2v_H v_L + 1}{4(v_H - v_L)^2} > 0,$$

because both the denominator and numerator are positive. Taking these together, we have shown that

$$\frac{\partial \Delta}{\partial v_H} > 0.$$